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Title: Environmental Management and Audit training at the New University of Lisbon by University-Industry co-operation

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Abstract

This paper describes the experience of a joint university-industry effort, under the course "Project on Environmental Management and Auditing", in the Environmental Engineering program at the New University of Lisbon. In this course, students are divided in audit teams and perform environmental audits in operating companies or institutions. The course has shown remarkable success, in all respects. The total number of case studies so far is 50. They have covered many fields of activity, including among others: chemicals, cement, electricity, gas, metalwork, pulp and paper, auto components and assembly, construction works, waste treatment, shopping centres, fuel and chemical storage, public and cargo transportation, an airport, military bases, insurance business, tourism, a natural preserve, zoos and aquariums, and the UNL Campus itself at Caparica. Relations with the audited companies or institutions have been quite positive, by means of carefully drafted protocols that ensure a mutually acceptable methodology and scope of the audit, along with undisclosure clauses. We have found this a very positive experience for all concerned: the students, the companies or institutions and the University.

1. Introduction

The importance of Environmental Management Systems (EMS) for the environmental and economic performance of industry and other business in the twenty-first century has become a matter of consensus. Many authors have published case studies of successful examples of EMS as applied to a variety of situations, mostly in the industrial sector.
Alas, the story of co-operation between business and industry, the prime users of EMS, and the University, the prime educators of environmental managers, is a different matter.
Business and University are two worlds that need each other, but often misunderstand each other. We often hear complains from University on the grounds that Business is interested in short-term money rather than best technology and long-term efficiency, and complains from Business on the grounds that University is interested in teaching whatever they happen to master rather than things that matter in real life. Of course there are many and increasing examples of good co-operation between University and the "outside World", but mostly those are the exceptions, not the rule.
This paper describes one case of success: the co-operative effort between a number of companies and institutions and the Department of Environmental Science and Engineering (DCEA) at the New University of Lisbon (UNL), as applied to training on environmental management and auditing.

2. Environmental management in Portugal

As in other countries, environmental management began with the extension of existing ISO 9001 or 9002 certified quality management to encompass ISO 14001 environmental management, under a strategy of total quality management. This movement was further spurred by the obligation of environmental auditing to apply for subsidies directed at industry modernisation, under the European-funded PEDIP program.
Progressive internationalisation of Portuguese industry has led to the recognition that our industry and economy is far behind European average in what concerns environmental performance, organisation and investment. Many companies have experienced demands from foreign clients for evidence of environmental performance. Other advantages such as overall efficiency, often with cost-saving, and better public relations with authorities and the public have also been recognised. The inefficiency of Portuguese industry and business is so bad (e.g. regarding materials, energy and water use and waste production) that implementing EMS often pays off quite rapidly.
Nowadays, no self-respecting business, be it in the industry, service and commerce or tourism, can afford to ignore the Environment. Many have chosen to set up EMS according to ISO 14001, even if they are not immediately applying for certification.
For years, the European Environmental Management and Audit Scheme (EMAS, originally set up by EC Regulation 1836/93) had little effect on promoting EMS, mostly because it was regarded as a competitor to ISO 14001, but less interesting because of implementation difficulties, European-limited and industry-limited scope. The review of EMAS by EC Regulation 761/2001 drastically changed this state of affairs, and EMAS is now being regarded as a clear upgrade of ISO 14001, with many companies setting up their EMS to comply with both norms.

3. The approach of the New University of Lisbon

The DCEA-UNL was the first university department in Portugal to offer full undergraduate courses on Environmental Management and Auditing, since 1995/96. As many other people thereafter, we believed from start that EMS was an environmental policy instrument with very high potential, and also one especially suited to the background of our Environmental Engineering graduates.
We have structured training in EMS in two semester courses, on the fifth and last year of the undergraduate program on Environmental Engineering at UNL.
All students enrolled in these courses had previously four years study on the standard engineering courses plus life sciences, earth sciences, social sciences, and environmental sciences and engineering covering ecology, pollution control, land use management, environmental modelling, environmental economics, impact assessment and information systems, which make up the basic curricula of Environmental Engineering at UNL.
The first (theoretical) course covers: EMS set-up and implementation; certification under the ISO 14000 family, the ISO 9000 family and the upcoming ISO 19000 (integrated management); registration under EMAS; auditing procedures; and eco-design according to principles such as described in Graedel and Allenby (1996).
The second (practical) course consists on having the students perform an actual full-scale audit at an operating company or institution. The purpose is both to train the students on-the-job as environmental managers, auditors or consultants, and to create links of understanding and co-operation with the visited companies or institutions. The experience of his course, called "Project on Auditing and Eco-Management" and run by the author, is focused in the remainder of the paper.

4. Methodology

The course "Project on Auditing and Eco-Management" is set up as a series of bilateral projects between the University and a number of companies or institutions, with the steps indicated in Table 1.
The students are first organised in groups of three or four, each acting as an audit team. Each team chooses the company or institution they want to audit. The suggestion for a case-study may come from the company or institution, from the faculty or from the students themselves.
Each project is initiated with an informal contact from the University to the company or institution, to ascertain their interest. A formal letter immediatly follows, stating the proposed terms of reference for the project. In between, case studies, most from former projects, are discussed in class as preparation for the audit.
The goals, scope and calendar of the work are mandatorily defined by common agreement between the company or institution, the faculty and the students. Only issues that all parts agree on will be included in the scope of the audit. This is discussed during a three-party preliminary meeting and visit to the site to be audited.

Table 1 — Steps in the Project on Auditing and Eco-Management

Step	Parties involved	Place and duration
1. Set up the students in audit teams and choose the company or institution	Faculty and students	Two 3-hour classes at the University
2. Case-study discussion	Faculty and students	Three or four 3-hour classes at the University
3. Initiation of project	Faculty and company or institution	Half an hour per project, by phone and mail or e-mail
4. Preliminary meeting	Faculty, students and company or institution	Site to be audited, half a day per project
5. Approval of workplan	Students, faculty and company or institution	Separate 1-hour meetings at University and site
6. On-site information gathering	Students and company or institution	Several day-long meetings at the site during two calendar months
7. Off-site information gathering	Students	Two calendar months
8. Advising and methodology discussion	Students and faculty	Average six hours per project during three months, at the University
9. Site verification	Students and company or institution	One or two days at the site
10. Final meeting	Students and company or institution	Half a day at the site
11. Report discussion	Students and Faculty	Half a day at the University
12. Final presentation	Students, faculty and company or institution	Two-hour meeting at company or institution

A workplan, stating the goals, scope and calendar of the audit, is then drafted by the student audit team, and is formally approved by both the faculty and the company or institution.
Confidentiality is always a touchy issue. A non-disclosure agreement comprehends the following points: (i) all information considered within the predefined scope of the audit is open for consultation by the audit team; (ii) all basic data are strictly confidential regarding third parties; (iii) no extra copies of the audit report may be made without the prior consent of the audited company or institution (the faculty receives one copy that is

kept locked); (iv) the report of the audit is confidential regarding the general public, but may be consulted for academic purposes by students and researchers at the University, subject to the same constraints. Often companies require students and faculty to sign a confidentiality term. This way, no problems of data dissemination arise, but we have been able to develop a wonderful library of case studies on eco-management and auditing.

The agreement on costs is usually as follows: there is no payment of fees to either the University or the students. However, all expenses, such as transportation, meals, photocopies and the like, are either provided or paid for by the audited company or institution. Usually, the costs are small and the project does not require a formal budget.

After the working plan is approved, the real work begins. First, the audit team develops checklists for necessary information and, with this as guideline, reviews the relevant documentation in the organisation, either integrated in a formal EMS or not. This will usually involve also interviews with key staff at the site. In parallel, they research additional information elsewhere.

Orientation is provided by the University on matters of methodology, and by the company or institution regarding the site visitation and gathering of information. This is important because the students will require a lot more on-site advising than a professional audit team would, and that means that someone from the company must be available to provide that support. Regular advise by University faculty is also essential, because hurdles happen often, in matters such as law interpretation, data treatment methodology or human relations.

With essential information in hand, the audit team develops specific checklists for site verification, which is then conducted at a pre-determined date. With a preliminary report in hand, the audit team conducts a final meeting with the company or institution, to informally discuss findings and doubts. Thereafter they draft the final report, which is discussed with the faculty.

Finally, the report and findings of the audit are formally presented to top management at the company or institution.

Total duration of the project is typically five calendar months, or the equivalent to two months full-time work for the students.

5. Scope of the audit

According to the level of development of the environmental management system in the company or institution, the audit may have one or more of the following goals:

- Performing an environmental survey according to EMAS;
- Identifying the needs or flaws regarding ISO 14001 certification or EMAS registration;
- Auditing operations, procedures and/or EMS, including legal compliance analysis;
- Identifying opportunities to improve environmental performance;
- Developing parts or proposals for EMS documentation.

Part of theses goals represent standard audit work, part would normally be done by consultants. The methodology distinguishes both types of work, but we found that the training is more effective if the students perform both typical-auditing and typical-consulting tasks.

Environmental domains included in the scope of the audit are typically the following:

- Water and energy use;
- Consumption of other raw materials and natural resources;
- Waste production and management, including liquid and gas effluents and other waste;

- Impacts or influence on the surrounding environment;
- Safety and risk issues implying hazards for visitors or the environment;

Activities of the company or institution to be evaluated may include the following:

- On-site operations, such as industrial production, maintenance and support services;
- Off-site operations such as transportation of products, construction or mounting of equipment at clients site or off-site services;
- Design of products and services;
- Administration;
- Suppliers environment performance control;
- Public relations and education activities towards clients or visitors;
- Staff training regarding the environment.

6. Results

Table 2 lists the 50 audited case studies performed in the course "Project on Auditing and Eco-Management" in the past six years.

Table 2 — Audited case studies

Company or institution	Field of activity	Audited site or operations	Year	Status
Ambimed	Hospital waste treatment	Treatment plant at Barreiro	2001	Report delivered
Administração do Porto de Lisboa	Harbour operations	Two cargo terminals at Lisbon harbour	2001	Report delivered
CCB - Centro Cultural de Belém	Culture	Conference centre and Auditorium at Lisbon	2001	Report pending
Contacto	Construction	Two work sites and environmental procedures	2001	Report delivered
CPB - Companhia Petroquímica do Barreiro	Chemical industry	Plant at Barreiro	2001	Formally presented
Hotel D.Pedro	Tourism/lodging	Hotel at Lisbon	2001	Report pending
Feira Nova	Retail commerce	Megastore at Sintra	2001	Report delivered
Hospital Garcia de Horta	Health care	Hospital at Almada	2001	Report pending
Imoareia	Tourism	Tróia Resort, Grândola	2001	Report delivered
Oceanário de Lisboa	Aquarium	Aquarium at Lisbon	2001	Formally presented
OM Farmacêutica	Pharmaceutical industry	Plant at Alfragide, Amadora	2001	Report pending
Petrogal	Oil industry	LPG storage and terminal at Porto	2001	Report delivered
Reserva Natural do Estuário do Tejo	Nature conservation	Operations and compliance with legally stated goals	2001	Report delivered
ANA-Aeroportos de Portugal	Airport operations	Faro airport	2000	Formally presented
Direcção-Geral dos Desportos	Sports public facility	Sports complex at Jamor, Oeiras	2000	Report delivered
Dispar	Retail commerce association	Labelling and collection of waste packaging	2000	Formally presented
Fima	Food industry	Plant at Sta. Iria de Azóia, Loures	2000	Formally presented
Lisboa Gás	Gas distribution	Network construction and operation at Lisbon	2000	Report delivered
Aquário Vasco da Gama	Aquarium	Aquarium at Lisbon	2000	Formally presented

Portucel	Pulp industry	Plant at Setúbal	2000	Formally presented
Setgás	Gas distribution	Network construction and operation at Setúbal peninsula	2000	Formally presented
Sonae Imobiliária	Real estate	Vasco da Gama shopping centre at Lisbon	2000	Formally presented
Transgás	Natural gas transport	National gas pipeline operation and administration	2000	Formally presented
Valorsul — CTRSU	Urban waste treatment	Incineration plant at S. João da Talha, Loures	2000	Formally presented
Autoeuropa	Auto assembly	Plant at Palmela	1999	Formally presented
Força Aérea Portuguesa	Military	Air Force Base 6 at Montijo	1999	Report delivered
Força Aérea Portuguesa	Military	Air Force base and hospital at Lumiar, Lisboa	1999	Formally presented
Bonança	Insurance	Headqurters and environment-related operations	1999	Report delivered
Sonae Imobiliária	Real estate	Colombo shopping centre at Lisbon	1999	Formally presented
Sonae Distribuição	Retail commerce	Megastore at Amadore and logistic centre at Azambuja	1999	Formally presented
EDP - Electricidade de Portugal	Electricity	Power plant at Setúbal	1999	Formally presented
Rodoviária de Lisboa	Passenger transportation	Operations centre 7 at Sta. Iria de Azóia, Loures	1999	Formally presented
Salvador Caetano	Auto assembly and repair	Repair shop at Sacavém, Loures	1999	Report delivered
Siemens	Electric equipment industry	Electric board plant at Corroios, Seixal	1999	Report delivered
Secil	Cement industry	Cement plant at Outão, Setúbal	1999	Formally presented
Jardim Zoológico de Lisboa	Zoo	Zoo park at Lisbon	1999	Report delivered
Shell	Oil industry	Fuel yard and terminal at Banática, Almada	1998	Formally presented
Força Aérea Portuguesa	Military	Air Force Base 1 at Sintra	1998	Formally presented
Sonae Imobiliária	Real estate	Cascais shopping centre	1998	Formally presented
Ferro	Chemical industry	Plant at Castanheira do Ribatejo, Vila Franca de Xira	1998	Formally presented
Siemens	Electric equipment industry	Electric transformer plant at Sabugo, Sintra	1998	Formally presented
Lever	Chemical industry	Plant at Sacavém, Loures	1998	Formally presented
Inapa	Paper industry	Plant at Setúbal	1998	Report delivered
Universidade Nova de Lisboa	Higher education	Campus at Caparica, Almada	1998	Formally presented
Dyrup	Chemical industry	Paint plant at Sacavém, Loures	1998	Report delivered
GDL - Gás de Lisboa	Chemical industry	Gas production plant at Lisbon	1997	Report delivered
Sonae Distribuição	Retail commerce	Megastore at Cascais	1997	Formally presented
Indelma (Siemens)	Electric equipment industry	Auto cable plant at Casal do Marco, Seixal	1997	Formally presented
Portucel Florestal	Forestry	Environmental procedures and	1997	Report

		forestry operations at one site		delivered
Transportes Luís Simões	Cargo transport	Operations, administration and repair shop	1996	Report delivered

7. Conclusion

This experience began six years ago, and has shown remarkable success, in all respects. The total number of case studies so far is 50. Enrolment went up from four students in 1995/96 to 45 in 2000/01. Companies and institutions audited yearly went up from one in 1995/96 to 13 in 2000/01. They have covered many fields of activity, including among others: chemicals, cement, electricity, gas, metalwork, pulp and paper, auto components and assembly, construction works, waste treatment, shopping centres, fuel and chemical storage, public and cargo transportation, an airport, military bases, insurance business, tourism, a natural preserve, zoos and aquariums, and the UNL Campus itself at Caparica. They range from small outfits to the largest Portuguese companies in many sectors.

Relations with the industry have been quite positive, by means of carefully drafted protocols that ensure a mutually acceptable methodology and scope of the audit, along with undisclosure clauses regarding data and reporting. This does not mean that the work went unnoticed: most reports have been formally presented to top management or in internal training courses, and many suggestions from the students were followed up. Indeed, many of these students were readily employed by the same companies or by environmental consultancy companies upon graduation. Some companies have used the experience to foster their EMS or make public presentations, such as Barrinha at al (1999).

In a nutshell, we have found it a very positive experience for all concerned: an excellent on-the-job training opportunity for the students, cheap qualified labour for companies, especially when essaying a new EMS, and prestige for the University.

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Short *curriculum vitae*

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